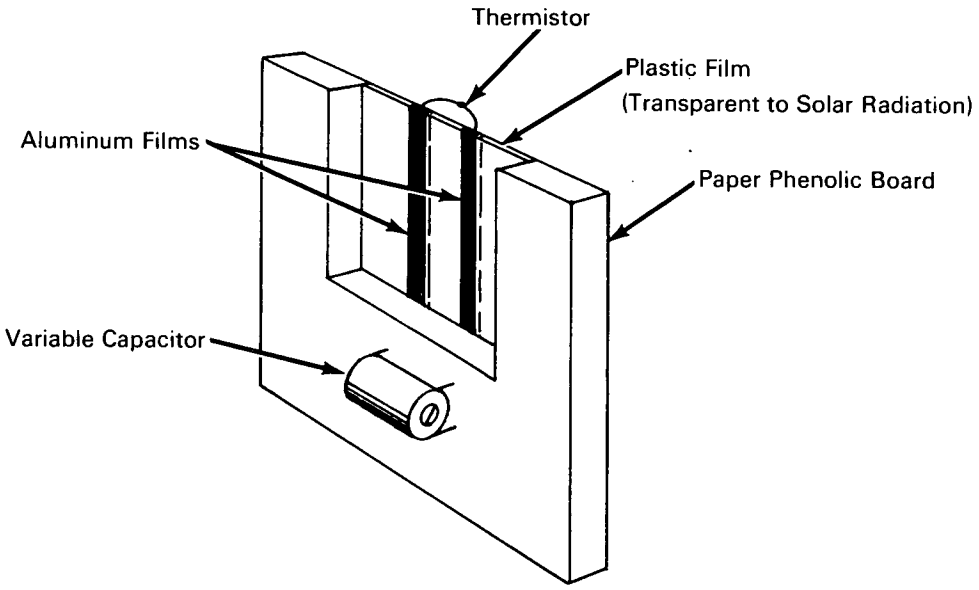
NASA TECH BRIEF

Thermistor Connector Assembly Increases Accuracy of Measurements



The problem: Accurately measuring ambient air temperatures with a thermistor which is subject to spurious heat transfer by conduction through its mounting and electrical leads. The thermistor is to be rigidly mounted as a probe to be used in conjunction with high-frequency radio instrumentation which will telemeter high-altitude air temperatures from a meteorological sounding system. Under these operating conditions, sources of heat transfer which can introduce errors into the temperature measurements arise from ohmic heating in the instrumentation package, radio frequency heating, and solar radiation. In order to minimize these errors, the thermistor mounting and connectors must have a low thermal mass and large area, so that they can rapidly come to equilibrium with the ambient air; they must be highly reflective or transparent to solar radiation; and they must be protected against absorption of the high-frequency radio waves transmitted by the telemetering system. The thermistor leads must be very short, as they are poor reflectors of solar radiation.

The solution: A mounting which effectively isolates the thermistor from spurious heat transfer due to ohmic heating, solar radiation, and absorption of high-frequency radio energy. The thermistor is connected to the mounting by means of very short leads.

How it's done: A 1-mil-thick film of transparent plastic is firmly bonded to a 1/16-inch-thick U-shaped paper phenolic board. This assembly is suitably masked and two films of aluminum are vacuum deposited on each face of the plastic film. Aluminum is also

(continued overleaf)

deposited on the upper edge of the plastic film, so that the aluminum films form a pair of inverted U-shapes (as viewed from the edge of the plastic film). The leads of the thermistor are soldered to the aluminum films at the U-bends. The aluminum films are approximately 15,000 Angstroms thick and 2 millimeters wide and are separated by approximately 3 millimeters. The length of each leg of aluminum film is made equal to one-quarter of the wavelength of the radio energy to be transmitted. These legs thus form a resonant transmission line which is capable of short-circuiting the radio energy appearing across them and thereby prevent its conversion to heat. In addition to serving as a short-circuiting means, the aluminum film has a high reflectance for solar radiation and therefore gains little heat from this source. A variable capacitor is mounted on the phenolic board and is electrically connected to the bottom ends of the aluminum films. This capacitor is used for fine-tuning the aluminum-film transmission line to one-quarter the wavelength of the radio energy. Connections to an external dc measuring circuit (which is part of the telemetering system) are soldered to the ends of the film strips near the capacitor.

Notes:

1. Tests on the thermistor mounting assembly indicate that the need for tuning is not critical; it should therefore be practical to replace the variable capacitor with one of fixed value.
2. This assembly should be useful for accurately measuring the temperature of air or other gases in environments where thermal radiation and radio frequency heating may cause problems.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Langley Research Center
   Langley Station
   Hampton, Virginia, 23365
   Reference: B65-10045

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

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